REVIEW OF ABUNDANCE OF MID-ATLANTIC COASTAL MORPHOTYPE OF BOTTLENOSE DOLPHIN DURING WINTER AND SUMMER 2002

By

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External Review Conducted for the Center of Independent Experts
University of Miami

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Executive Summary

1. The Southeast Fisheries Science Center, Protected Species and Biodiversity Division of NOAA Fisheries undertook aerial surveys to estimate the abundance of the coastal morphotype of bottlenose dolphins in the Mid-Atlantic region during the winter and summer of 2002.

2. I reviewed the 2002 abundance estimates of Mid-Atlantic bottlenose dolphins focusing on the following issues: the appropriateness of the design, execution, and analysis of the aerial surveys, the appropriateness of the statistical methodologies used to distinguish the spatial distribution and habitats of coastal vs. offshore morphotypes, the appropriateness of the resulting abundance estimate for coastal morphotype, and to determine if potential biases had been adequately identified and whether appropriate measures of statistical uncertainty had been included in the resulting abundance estimates.

3. Two approaches were used to define the spatial distribution of the coastal morphotype: spatial analysis of dolphin sightings per unit of effort to look for gaps in distribution and analysis of the locations of genetically determined morphotypes. General additive models were developed to predict dolphin sightings per unit of effort as a function of sea surface temperature, depth and distance from shore. Significant relationships with covariates were found, but these models failed to provide evidence of gaps that could be used to predict the occurrence of the coastal morphotype. Logistic regressions were fit to estimate the probability of encountering a genetically determined coastal morphotype as a function of those same habitat variables. Predictive models could not be developed in all areas due to limited biopsy sampling data. Some of the logistic models provided a reasonable basis for prediction while others had wide confidence limits indicating low predictive capability.

4. The use of genetic differences to determine the spatial distribution of morphotypes assumes representative spatial biopsy sampling of both types. Obtaining a biopsy from a free-ranging bottlenose dolphin is expensive, logistically demanding and, in many cases, requires the cooperation of the study animal. Therefore, there are unavoidable sampling biases. Detailed analyses of the biopsy data should be undertaken to determine the likelihood of bias in sampling one morphotype over the other.

5. Locations of biopsy samples are somewhat bimodal with most coastal individuals having been sampled quite close to shore and most offshore types sampled well offshore. Data are rather sparse across the middle zone, making estimation of the spatial distribution of the two types problematic. The biopsy sampling to date has not been sufficient to have a high degree of confidence in estimates of the spatial distribution of the coastal morphotype throughout the seven management units and seasonally. Despite the considerable effort that has been devoted to obtaining biopsy samples, there appears to be no overall strategy that would guide the collection of samples.

6. The abundance of bottlenose dolphins in coastal U.S. waters between 0-40 m was estimated from line-transect aerial surveys conduct during the summer and winter of 2002. These surveys were designed to estimate overall abundance in each management unit and to address three shortcomings of abundance surveys conducted in 1995. First, survey coverage was designed based on the current management units. Second, the sighting probability function was re-estimated and fit to a unimodal, sighting function and third, the abundance estimates were corrected for visibility bias. The current surveys address former shortcomings well.

7. The abundance estimation problem is difficult in this case as there is both a latitudinal and an inshore-offshore structure throughout the species Mid-Atlantic range. In my view, these were well-designed, executed, and analyzed aerial surveys of the abundance of bottlenose dolphins in the Mid-Atlantic region. With the exception of availability bias (which likely is not that significant), sources of uncertainly have been reasonably incorporated into abundance estimates.

8. CVs on coastal morphotype abundance are larger than the planned level of precision for most management units, including some with high survey effort and presumably high fishery-related dolphin mortality. Reducing variability in perception bias and increasing the number and spatial coverage of biopsy sampling would reduce the uncertainty.

Background

The Southeast Fisheries Science Center, Protected Species and Biodiversity Division of NOAA Fisheries undertook aerial surveys to estimate the abundance of bottlenose dolphins in the Mid-Atlantic region during the winter and summer of 2002. Based on genetic data, two morphotypes of bottlenose dolphins are recognized in this region: a coastal and an offshore type. The intent of the 2002 aerial surveys was to obtain current information on the winter and summer abundance of coastal morphotype in management units that are subject to incidental takes (i.e., mortalities) in coastal gillnet fisheries. This information is required by a Marine Mammal Protection Act (MMPA) Take Reduction Team (TRT), which began to deliberate the status of these dolphin populations in a series of meetings in 2002. Therefore, there is a need to understand the spatial distribution of the two morphotypes such that the current abundance estimates can be properly associated with the coastal morphotype only.

As specified in the Statement of Work, I reviewed the 2002 abundance estimates of Mid-Atlantic bottlenose dolphins focusing on the following issues:

1. The appropriateness of the design, execution, and analysis of the aerial surveys used to derive abundance estimates for bottlenose dolphins in the Mid-Atlantic.

2. The appropriateness of the statistical methodologies used to distinguish the spatial distribution and habitats of coastal vs. offshore morphotype bottlenose dolphins.

3. The appropriateness of the resulting abundance estimate for coastal morphotype bottlenose dolphins from combined genetic data, spatial distribution information, and aerial survey data.

4. To determine if potential biases have been adequately identified and whether appropriate measures of statistical uncertainty have been included in the resulting abundance estimates.

The documents provided for review are listed in Appendix A.

Structure of the Mid-Atlantic Population

The abundance estimation problem is difficult in this case as there is both latitudinal and an inshore-offshore structure throughout the species Mid-Atlantic range. As indicated in the report, two bottlenose dolphin morphotypes are recognized in this area: a “coastal” and an “offshore” type, which can be distinguished based upon differences in morphometry, blood chemistry, feeding habits, and genetics (both mtDNA and nuclear markers). Latitudinal structure is based mainly on differences in genetics and resighting of photographically identified individuals, with additional data from regional differences in the levels of stable isotopes and the movements of radio-tagged individuals. There is also clear evidence of seasonal differences in the distribution of dolphins along the coast.

During the winter, the dolphins in the northern migratory management unit move south and mix with dolphins from the northern North Carolina and North Carolina management units. Thus, a fundamental pre-requisite is to understand the spatial and temporal distribution of bottlenose dolphin morphotypes and to determine how best to partition the latitudinal population structure. For the purpose of this review, the management units are taken as outlined in the report. I have not reviewed the basis for the boundaries of the management units.

Spatial distribution of dolphins during surveys

General additive models (GAM) were developed to identify spatial patterns in the distribution of bottlenose dolphins with respect to several habitat variables – depth, sea surface temperature, and distance from shore. The goal here was to identify gaps in the spatial distribution of dolphins along aerial survey transects that might indicate discontinuities in the distribution of the coastal and offshore types. General additive modelling is a powerful and flexible approach to developing spatial models. As described, the approach to model selection and fitting methods seem quite appropriate. A nonparametric bootstrapping procedure is used to estimate uncertainty in the predicted sightings per unit of effort (SPUE).

I found Figs. 2 and 3 rather difficult to interpret. Given the broad geographic limits of the study area, separate plots of each management unit would have been preferable. I realize that authors were likely trying to keep the report as concise as possible, but the current figures are not that informative. It would also have been useful to indicate the number of groups sighted in each management unit during the summer and winter surveys, as these cannot be readily determined from the plots.

GAMs were fitted to each management unit to attempt to develop a predictive equation of dolphin SPUE in relation to the habitat variables. For each management unit the authors also examined the relationship between group size and distance from shore. Presumably, this analysis was done to examine for bias in the detection of groups. The authors note on p.22, that although there was no significant relationship between log transformed group size and distance from shore in the northern migratory unit, there was evidence of a trend toward decreasing group size with distance from shore in the raw data (see Fig. 10). This trend is also restated on p.25 in a somewhat firmer way. However, I could find little evidence for this trend. Similarly, as there is no relationship between group size and distance form shore in Fig. 13b, the regression line should not be plotted. The conclusion at the bottom of p.22 and top of 23 is not supported by the data, but this conclusion is not central to the main objectives of the study.

The GAM fit several areas well, such that one might make reasonable predictions about the sightings per unit effort (SPUE) of dolphins. The GAM clearly does not fit the data well in the South Carolina management unit. Even in cases where the fit is rather good, it is not clear how these models inform us with respect to the distribution of the two morphotypes. From the raw data in Fig. 9, 11, 12, 15, 16 and 18 there appear not to be clear gaps in SPUE with distance from shore. Only in Fig. 14 (i.e., South Carolina) is there a weak suggestion of a gap in distribution at roughly 20-30 km from shore. Thus, as far as I can determine, the GAM really provide little insight into the spatial distribution of the two morphotypes. For example, the conclusion on p.26 that there is little mixing between the morphotypes in the northern migratory and northern North Carolina management units rests on data from offshore observations (i.e., >50 km) from surveys in other years that were not included in the GAM. Furthermore, the discussion with respect to the North Carolina, South Carolina, and Georgia management units appears to rely on subjective inspection of the raw data rather than on model results. Using GAM to test for discontinuities in SPUE that might be informative about the distribution of the two morphotypes is sound in principle. In practice however, the data provide little evidence of spatial separation of the morphotypes.

Spatial distribution of dolphin morphotypes

Although the coastal and offshore morphotypes can be distinguished using multivariate data, they cannot be distinguished during aerial surveys that are conducted to estimate abundance. Biopsy sampling for genetic analysis is used as the operational field tool, presumably because it is difficult or impossible to routinely collect other types of information that can be used to identify the morphotypes and because genetic assignment is more accurate,. On p.2 and again on p.12, it is stated that individual animals can be positively identified to a particular morphotype from genetic analysis (P. Rosel, unpublished data). While I have no reason to doubt this conclusion, it seems quite critical that the method for doing so be published in the primary literature or otherwise made available so that the conclusion can be examined. Thus, I **recommend** that the method for genetically typing the two morphotypes be published.

i) Collection of skin biopsies

The use of genetic differences to determine the spatial distribution of morphotypes assumes representative spatial biopsy sampling of both types. As noted by the authors, obtaining a biopsy from a free-ranging bottlenose dolphin is not straightforward. The process is expensive, logistically demanding and, in many cases, requires the cooperation of the study animal. Therefore, there are unavoidable sampling biases. The authors are clearly aware of potential for bias arising from the limitations of different sampling platforms and differences in the degree of cooperation exhibited by dolphins. Nevertheless, I believe it would be useful to provide more detail and analysis of the biopsy sampling data. For example, as different platforms sample dolphins in different ways it is important to know what fraction of biopsies came from bowriding vs. non-bowriding dolphins, as a function of depth or distance from shore. I **recommend** that analyses of the biopsy data be conducted for the purpose of shedding light on the likelihood of bias for sampling one morphotype over the other.

A limitation of the biopsy sampling expressed by the authors, and shared by this reviewer, is that the locations of biopsies are rather bimodal with most coastal individuals having been sampled quite close to shore and most offshore types sampled well offshore.

Thus the data are rather sparse across the middle zone. A histogram showing the number of each morph as a function of distance from shore would have illustrated this nicely and complimented Fig. 25. The situation is perhaps even more serious in winter as the total number of samples is rather small and some management units have almost no samples (e.g., South Carolina).

Individual groups of dolphins are considered the sampling unit, and Tables 11 and 12 provide the number of locations where biopsies were taken. Although that rationale for using groups as the sampling unit is clear, as groups are discovered, not individuals, listing only the number of locations creates some confusion, as the number of biopsies is given in the text on p.13-15. The number of biopsies is considerably greater than the number of locations, indicating that multiple biopsies were taken at many locations. Thus, I suggest showing both the number of biopsies and the number of locations in the Tables.

A further concern with respect to the biopsy data is the observation that some dolphin groups are a mixture of both morphotypes. Where this was known to have occurred based on multiple biopsies from the same group, the group was scored twice, once for each morphotype. To understand the magnitude of this potential source of bias, more information is needed on the number of groups approached, the proportion of groups sampled, and the proportion with multiple samples from the same group, all as a function of distance from shore. The text states that it is difficult to collect multiple samples offshore. This certainly suggests that the proportion of mixed groups will not be well estimated and there may be a bias with respect to distance from shore.

ii) Distribution of the coastal morphotype

The assignment of individuals to coastal and offshore types from genetic analysis of biopsy samples was used to estimate the spatial distribution of morphotypes. The probability that an individual was a particular morphotype was estimated from logistic regression models using the same habitat variables (i.e., depth, sea surface temperature and distance from shore) as used in the GAM analysis as covariates. The spatial patterns identified in GAM and regional differences in biopsy sample distribution were used to group management units for this analysis into northern and southern areas. Separate models were developed for these combined areas and for summer and winter. Although separate models for each management unit might be warranted, the biopsy data are insufficient to pursue this detail at this time. Thus, the authors' decision to combine areas is a sensible approach.

The results of the logistic regressions were, for the most part, rather disappointing as predictive tools. Confidence limits are wide even for the best model (i.e., management units south of Cape Lookout). I do have one concern about the confidence limits, as it is not clear that the authors checked for overdispersion. In these kinds of models, the true variance is often greater than the assumed model variance leading to an underestimation of the standard errors. Despite their wide confidence limits, the logistic models are useful for two reasons. First, the models do suggest that with a larger sample of more evenly spaced (with respect to distance from shore) biopsy samples, such models could be used to reasonably predict the proportion of coastal types as a function of variables used to stratify and limit the boundaries of the coastal types in aerial abundance surveys. Second, the models provide an objective basis to estimate the probability of encountering a coastal morph as a function of habitat variables, even though our confidence in these probabilities is often low based on current data.

The conclusion that there is rather complete separation between the coastal and offshore types north of Cape Lookout during summer seems well supported by the available data. However, the data are spatially distributed in such as way to perhaps limit the robustness of this conclusion. As the authors note, current data do not preclude that mixing of the two morphotypes may occur where relatively deep water occurs close to shore. Furthermore, unpublished data (D. Palka, NMFS) suggest that there may be interannual variability in the degree of mixing between the morphotypes. Interannual variability in mixing of morphotypes would complicate the abundance estimation problem. However, if the degree of mixing were mediated by changes in sea surface temperature, then properly designed surveys could be used to develop predictive models, which account for changes in distribution brought about by changes in sea surface temperature. South of Cape Lookout there is extensive mixing of the coastal and offshore morphotypes. Biopsy data are insufficient to develop predictive models of the proportion of coastal types as a function of the habitat variables measured. As noted in the report, the small numbers of biopsy samples in winter make any conclusion about the spatial distribution of morphotypes tentative.

Although considerable effort has been devoted to obtaining biopsy samples, there appears to be no overall design, which governs the location and effort devoted to sampling over all management units. As a result the spatial distribution of samples is not optimal for estimating the spatial distribution of morphotypes. Obtaining adequate biopsy samples in winter will be challenging, both in terms of cost and logistics. However, present data are simply insufficient to provide more than a rough guide to the distribution of the coastal morphotype at this time of year. Summer data are wanting in some areas, but in other areas sample sizes appear adequate. Nevertheless, the spatial distribution of existing samples is not optimal to precisely estimate the distribution of the coastal morphotype. Therefore, I **recommend** that an overall sampling strategy be developed to guide the collection of biopsies for the purpose of determining the spatial distribution of morphotypes in summer and winter. This strategy should consider both the number and spatial distribution of samples needed to obtain the desired precision.

Abundance of Mid-Atlantic Bottlenose Dolphins

Aerial survey design

The abundance of bottlenose dolphins in coastal U.S. waters between 0-40 m was estimated from line-transect aerial surveys conducted during the summer and winter of

2002. These surveys were designed to estimate overall abundance in each management unit and to address three shortcomings of abundance surveys conducted in 1995. First, survey coverage was designed based on the current management units. Second, the sighting probability function was re-estimated and fit to a unimodal, sighting function. Third, the abundance estimates were corrected for visibility bias.

The survey was designed following the principles of state of the art line-transect estimation theory. The discussion of the underlying theory and the rationale for the particular implementation of the theory in the case of these dolphin surveys was well organized and clear. I was quite impressed with the care that when into the planning, design, and analysis of the resulting data. The abundance estimates are presented in a well-organized and clear fashion. I would generally agree with the authors that having not accounted for availability should introduce little bias in the estimates. This is because the large mean size of groups observed in most areas suggests that few groups would have been missed. Nevertheless, mean group size varied from only 1 to 3 in some areas during summer, suggesting that in those areas some groups could have been missed. Thus, it will be important to determine the effect of availability on estimates of abundance in the design of future surveys. The potential for bias due to availability in winter surveys would seem small given the larger groups observed at this time of year.

The survey was designed to cover all seven management units during summer and a modified set of units that reflect the contracted distribution of the population in winter. The highest survey effort was placed on management units with the estimated highest fishery-caused mortality rates. Although, I can see some rationale for taking this approach, more precise estimates of dolphin abundance might have been achieved by allocating survey effort proportional to dolphin abundance. However, examination of the abundance estimates for each management unit suggests that there is a correlation between fishery-related dolphin mortality and dolphin abundance. Therefore, the approach taken by the authors is similar to what would have been done using sampling proportional to abundance. Sampling effort was designed to achieve coefficients of variation (CVs) of about 20-30%. These are on the high side, but for a survey of this broad geographic scale and biological complexity this seems quite reasonable, and the CVs are similar to those achieved in other large-scale cetacean surveys.

Execution and data analysis

Execution of the summer and winter surveys seems to have gone well. The only mention of variance from what was planned was that the offshore lines were completed only as far south as the Georgia-Florida boundary. Relatively few dolphins were sighted south of this boundary, and thus this variance will have little impact on the overall estimate of abundance. Every effort seems to have been made to ensure that accurate data were collected onboard the survey aircraft. The estimation of abundance from the sightings data is quite thorough and appropriate.

Overall abundance

There is considerable variation in the visibility bias correction both within and between teams. As noted, the variability is greater for the less experienced team, underscoring the need to use experienced observers during such surveys. The estimated visibility bias correction has a large effect on the estimates within some management units, more than doubling some estimates. Therefore, it is important to understand the sources of this variability. Although sighting experience was identified, the variability within teams indicates clearly that there are other influential factors. However, as far as I can determine, the sources of variability of the visibility bias correction have not been thoroughly investigated. Until this has been done, I would be reluctant to conclude, as did the authors, that the results of the current study indicate relatively low perception bias. I therefore **recommend** that the sources of variability in the visibility bias correction be investigated with the view of reducing the variability in future surveys.

Abundance of coastal morphotype

To estimate the abundance of the coastal morphotype in each management unit, the overall abundance estimate was partitioned into each morphotype using the results of the logistic regression models and spatial “gap” analysis. As noted, this approach makes three assumptions: that the spatial distribution of the observed dolphins is representative of the underlying population distribution; that the group sighting probabilities are independent of location and the environmental variables at that location; that the logistic regressions are a good representation of the spatial distribution of each morphotype. I would agree with the authors that the first two of these assumptions are likely to be upheld in the current analysis or at least are consistent with the way in which the sighting data were treated in the estimation of overall abundance. However, I am less inclined to accept the third assumption given the concerns expressed above. Most biopsies were taken near shore or well offshore leaving a gap in the middle zone. In this gap, we seem quite uncertain as to the composition of dolphin groups.

Where no logistic model could be fit to the data, the results of the GAM spatial analysis of sightings was used to infer the coastal population. This analysis applies to the northern migratory and the northern North Carolina management units. These areas contain a large fraction of the estimated population. In these cases the negative exponential sighting curves were inspected to determine the distance from shore, where the confidence limits of the SPUE included zero. All sightings shoreward of this limit were assigned to the coastal morphotype. However, I can see little justification for this approach as in both areas few biopsy samples were taken from the middle zone of distances from shore. Thus the current assignment, though reasonably based on the limited data, may not be representative of the distribution of the coastal morphotype.

Given the rather high level of uncertainty in the predicted values from the logistic regressions, I was surprised that the CVs on the coastal morphotype abundance estimates increased by only 5-10%. I did not follow the explanation that these estimates were made because “we are essentially averaging across these models when combining them with the abundance data.” Perhaps this statement could be clarified.

Conclusions

In my view, these were well designed, executed, and analyzed aerial surveys of the abundance of bottlenose dolphins in the Mid-Atlantic region extending to the 40 m isobath. With the exception of availability bias, sources of uncertainly have been reasonably incorporated into abundance estimates. However, the biopsy sampling to date has not been sufficient to have a high degree of confidence in estimates of the spatial distribution of the coastal morphotype throughout the seven management units and seasonally. Further analysis is needed to determine the extent to which biopsy sampling may be biased in favour of one morphotype over the other. The methods used to predict the spatial distribution of the dolphin morphotypes are appropriate, but the results from these analyses are limited by the current distribution of biopsy sampling. The CVs on coastal morphotype abundance for the northern migratory and South Carolina management units are within the planned precision. In other areas, including those with high survey effort and presumably high fishery-related mortality, the CVs are high, indicating a great deal of uncertainty. Reducing variability in perception bias and increasing the number and spatial coverage of biopsy samples would reduce this uncertainty.

Appendix A

Anon. June 2001. Preliminary stock structure of coastal bottlenose dolphins along the Atlantic coast of the U.S. National Marine Fisheries Service.

Garrison, L. P., P. E. Rosel, A. Hohn, R. Baird, W. Hoggard. February 2003. Abundance of the coastal morphotype of bottlenose dolphin, *Tursiops truncatus,* in U.S. continental shelf waters between New Jersey and Florida during winter and summer 2002. NOAA Fisheries, Southwest Fisheries Science Center.

Garrison, L. and C. Yeung. 15 June 2001. Abundance estimates for Atlantic bottlenose dolphin stocks during summer and winter, 1995. National Marine Fisheries Service.

Garrison, L. June 2001. Seeking a hiatus in sightings for bottlenose dolphins during summer and winter aerial surveys. National Marine Fisheries Service.

Appendix B: Statement of Work

Consulting Agreement between the University of Miami and Dr. Don Bowen

January 21, 2003

General

NOAA Fisheries', Southeast Fisheries Science Center (SEFSC), Protected Species and Biodiversity Division undertook aerial surveys to estimate abundance of bottlenose dolphin in the Mid-Atlantic during the winter and summer of 2002. In addition, extensive skin biopsy sampling was conducted during 2001 and 2002 to allow genetic identification of coastal vs. offshore morphotype bottlenose dolphins and describe their relative spatial distribution. The intent was to obtain current information on the winter and summer abundance of coastal morphotype bottlenose dolphin management units that are subject to incidental takes (i.e., mortalities) in coastal gillnet fisheries. This information is required by a Marine Mammal Protection Act (MMPA) Take Reduction Team (TRT), which began to deliberate the status of these dolphin populations in a series of meetings in 2002. The TRT will reconvene in early April 2003 to revise previous recommendations for reducing fishery takes of bottlenose dolphins and consider new abundance estimates and other information as appropriate. The SEFSC is requesting that the Center of Independent Experts (CIE) undertake a peer review of the new abundance estimates and the statistical methodology used to develop them from the winter and summer 2002 aerial surveys.

The CIE consultant shall analyze the new mid-Atlantic bottlenose dolphin estimates focusing on the following issues:

1. The appropriateness of the design, execution, and analysis of the aerial surveys used to derive abundance estimates for bottlenose dolphins in the mid-Atlantic.

2. The appropriateness of the statistical methodologies used to distinguish the spatial distribution and habitats of coastal vs. offshore morphotype bottlenose dolphins.

3. The appropriateness of the resulting abundance estimate for coastal morphotype bottlenose dolphins from combined genetic data, spatial distribution information, and aerial survey data. Determine if potential biases have been adequately identified and whether appropriate measures of statistical uncertainty have been included in the resulting abundance estimates.

The consultant shall be provided the report to be reviewed, "Abundance of Mid-Atlantic Coastal Morphotype Bottlenose Dolphin During Winter and Summer 2002." The consultant shall also be provided and may consult extensive background material (listed in Appendix I) to assist in addressing the aforementioned issues.

The consultant shall conclude, in a written report, whether the analyses represent the best available information on which to proceed with protected species management for this population of bottlenose dolphin.

Specific

The consultant's duties shall not exceed a maximum total of two weeks- several days for document review and several days to produce a written report of the findings. The consultant may perform all review, analysis, and writing duties out of the consultant's primary location, as no travel is required. Finally, no consensus report shall be accepted.

The itemized tasks of the consultant include:

1. Reading and considering various supplementary reports (listed in Appendix I) that provide context and background on the bottlenose dolphin abundance surveys;

2. Reading and analyzing the SEFSC report, "Abundance of Mid-Atlantic Coastal Morphotype Bottlenose Dolphin During Winter and Summer 2002";

3. Submitting a written report of findings, analysis, and conclusions. No later than February 17, 2003, submit the written report[1] (see Annex I for formatting structure) addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Sampson, via email to David.Sampson@oregonstate.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu.

Signed____ Date______________

[1] The written report will undergo an internal CIE review before it is considered final. After completion, the CIE will create a PDF version of the written report that will be submitted to NMFS and the consultant.

ANNEX I: REPORT GENERATION AND PROCEDURAL ITEMS

1. The report shall be prefaced with an executive summary of findings and/or recommendations.

2. The main body of the report shall consist of a background, description of review activities, summary of findings, and conclusions/recommendations.

3. The report shall also include as separate appendices the bibliography of materials provided by the Center for Independent Experts and the Southeast Fisheries Science Center and a copy of the statement of work.

APPENDIX I: BACKGROUND MATERIAL ON BOTTLENOSE DOLPHIN SCIENCE

National Marine Fisheries Service. November 2001. Draft 2002 Stock Assessment Report for the Western North Atlantic Coastal Stock of Bottlenose Dolphin (Tursiops Truncatus).

National Marine Fisheries Service. September 2000. 2000 Stock Assessment Report for the Western North Atlantic Coastal Stock of Bottlenose Dolphin (Tursiops Truncatus).

Atlantic Scientific Review Group review of Bottlenose Dolphin documents. October 2001.

NMFS response to the Atlantic Scientific Review Group. November 2001.

Comments from one member of the Team for the CIE peer review. December 2001.

Letter from Rick Marks to the Honorable James V. Hansen and the Honorable Don Young of the U.S. House of Representatives Resources Committee regarding the bottlenose dolphin take reduction team process. August 2001.

NMFS response to Rick Marks letter to the House Resources Committee. September 2001.

Palka, D., F. Wenzel, D. L. Hartley, and M. Rossman. June 2001. Summary of bottlenose dolphin strandings from New York to Virginia.

Hohn A., P. T. Martone. July 2001. Characterization of bottlenose dolphin strandings in North Carolina, 1997-2000.

Hohn A., B. Mase, J. Litz, W. McFee, and B. Zoodsma. November 2001. Characterization of human-caused strandings of bottlenose dolphins along the Atlantic coast from South Carolina to Florida, 1997-2000.

References on Stock Structure

National Marine Fisheries Service. June 2001. Preliminary stock structure of coastal bottlenose dolphins along the Atlantic coast of the U.S.

Garrison, L. June 2001. Seeking a hiatus in sightings for bottlenose dolphin during summer and winter aerial surveys. National Marine Fisheries Service.

Garrison, L. and A. Hohn. October 2001. Abundance estimates for Atlantic bottlenose dolphins: combining strip transect data and line transect abundance estimation. National Marine Fisheries Service.

Garrison, L. and C. Yeung. 15 June 2001. Abundance estimates for Atlantic bottlenose dolphin stocks during summer and winter, 1995. National Marine Fisheries Service.

Palka, D., L. Garrison, A. Hohn, and C. Yeung. 1 November 2001. Summary of abundance estimates and PBR for coastal Turciops for waters between New York and Florida during 1995 to 2000. National Marine Fisheries Service.

Garrison, L. 2 July 2001. Mortality estimate for Atlantic bottlenose dolphin in the directed shark gillnet fishery of Florida and Georgia. National Marine Fisheries Service.

Rossman, M. and D. Palka. 3 October 2001. Bycatch estimates of coastal bottlenose dolphin (Turciops truncatus) in U.S. mid-Atlantic gillnet fisheries for 1996 to 2000. National Marine Fisheries Service.